

NATIONAL  
ACADEMIES

Sciences  
Engineering  
Medicine

# National Academies Studies on Climate Intervention

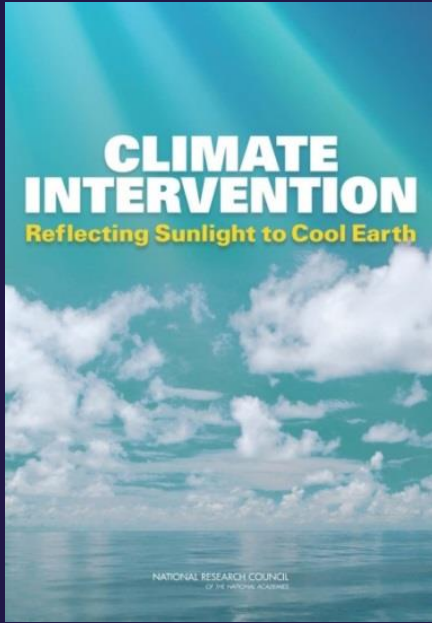
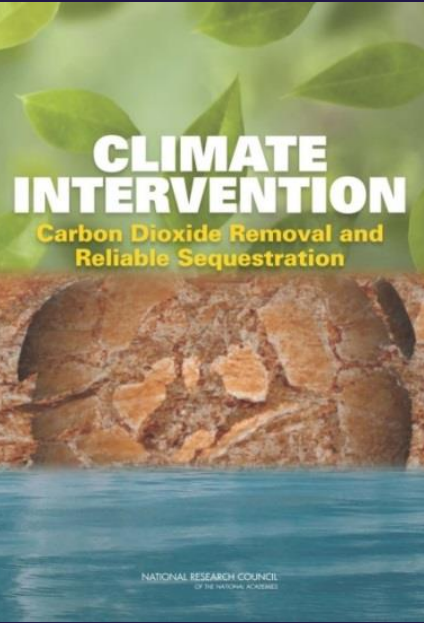
AGU Ethical Framework for Climate  
Intervention Research and Potential Scaling  
Global Convening, September 23, 2022

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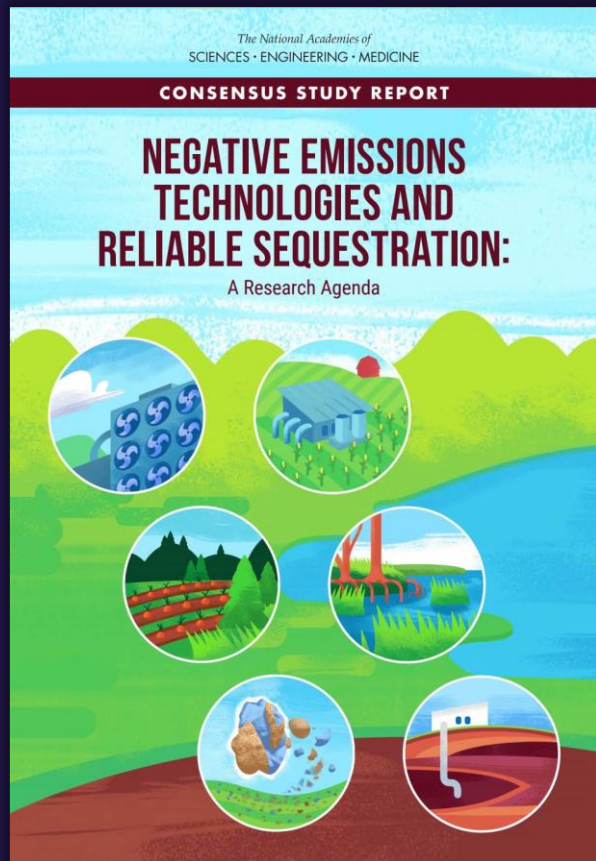


2015

The committee recommends the initiation of a serious deliberative process to examine (a) what types of research governance, beyond those that already exist, may be needed for albedo modification research, and (b) the types of research that would require such governance, potentially based on the magnitude of their expected impact on radiative forcing, their potential for detrimental direct and indirect effects, and other considerations.

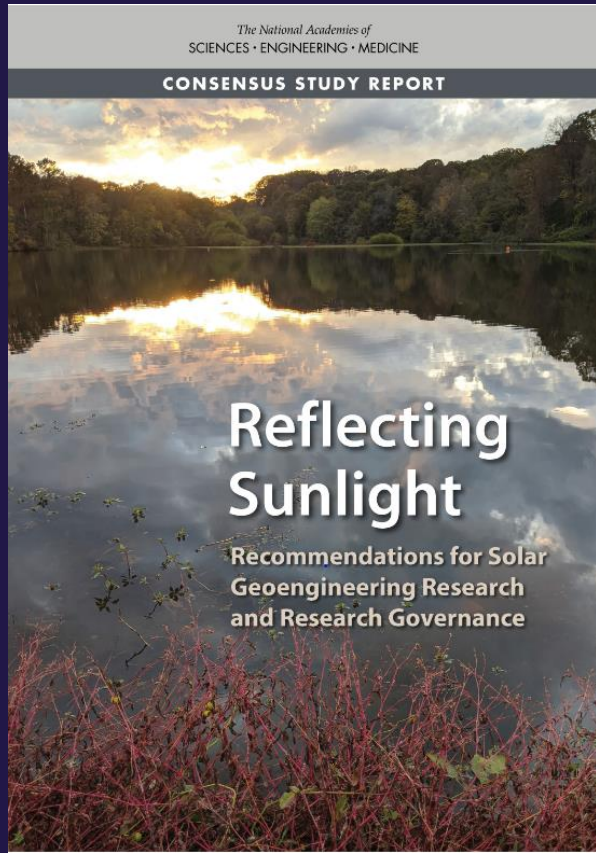
Carbon Dioxide Removal proposals...	Albedo Modification proposals...
... address the cause of human-induced climate change.	...do not address cause of human-induced climate change.
...do not introduce novel global risks.	... introduce novel global risks.
...are currently expensive (or comparable to the cost of emission reduction).	...are inexpensive to deploy (relative to cost of emissions reduction).
...may produce only modest climate effects within decades.	...can produce substantial climate effects within years.
...raise fewer and less difficult issues with respect to global governance.	...raise difficult issues with respect to global governance.
...will be judged largely on questions related to cost.	...will be judged largely on questions related to risk.
...may be implemented incrementally with limited effects as society becomes more serious about reducing GHG concentrations or slowing their growth.	...could be implemented suddenly, with large-scale impacts before enough research is available to understand their risks relative to inaction.
...require cooperation by major carbon emitters to have a significant effect.	...could be done unilaterally.
...for likely future emissions scenarios, abrupt termination would have limited consequences	...for likely future emissions scenarios, abrupt termination would produce significant consequences





2019

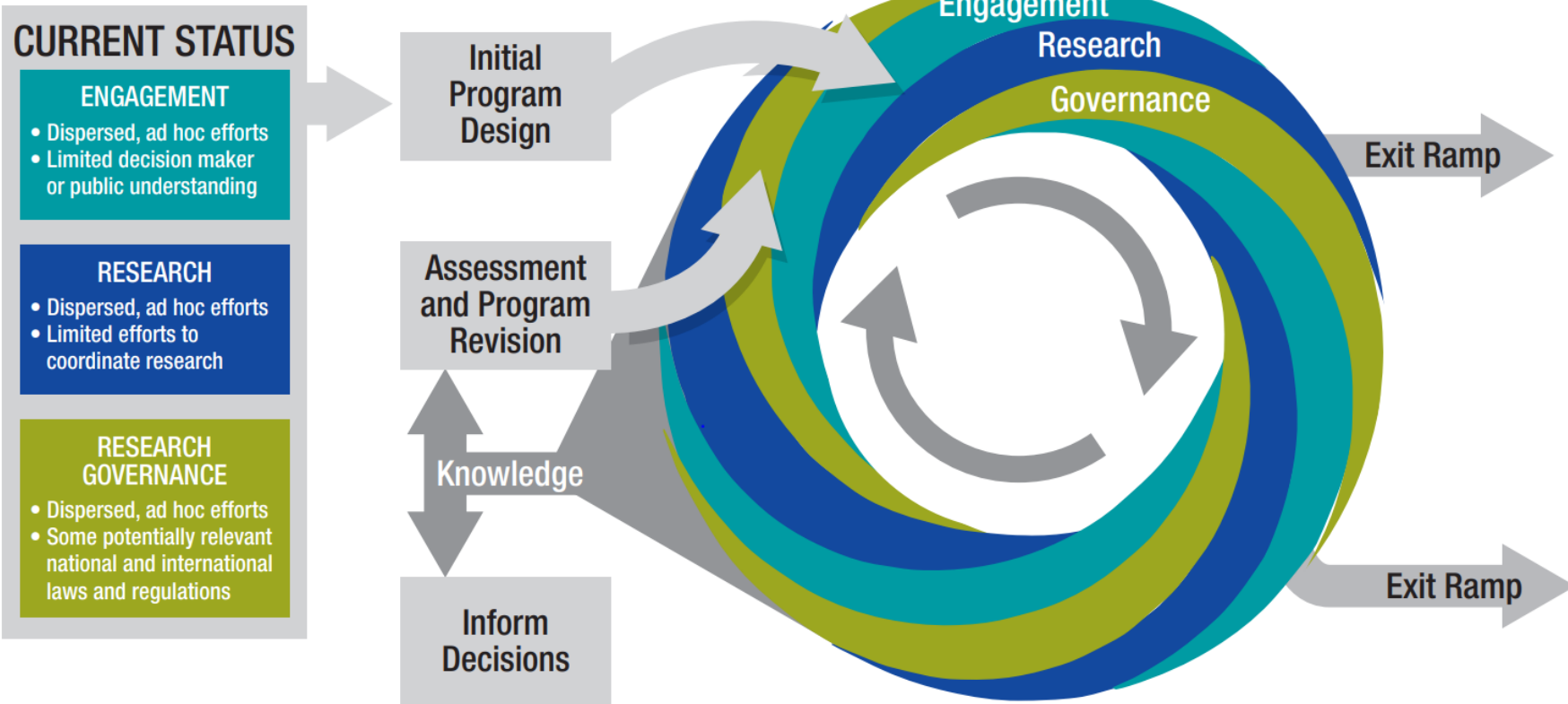
Appropriate governance of NETs and sequestration is critical because overly lax oversight would lead to ineffective CO<sub>2</sub> removal and loss of public confidence, while overly strict oversight would limit deployment. Governance is especially critical when large-scale deployment is imminent. [...] One way to maintain public confidence during rapid deployment of NETs is to invest in a substantial effort to educate the public during the research and development.



2021

**A U.S. national research program should operate under robust research governance and support the eventual development or designation of international governance mechanisms.**

- Code of Conduct
- Registry
- Data Sharing
- Assessments and Reviews
- Permitting
- Intellectual Property
- Participation and Stakeholder Engagement
- International Cooperation and Co-development on Research Teams
- Int'l Cooperation Among National Scientific Agencies
- Int'l Information Sharing and Cooperation
- Int'l Anticipatory Governance Expert Committee



# Code of Conduct

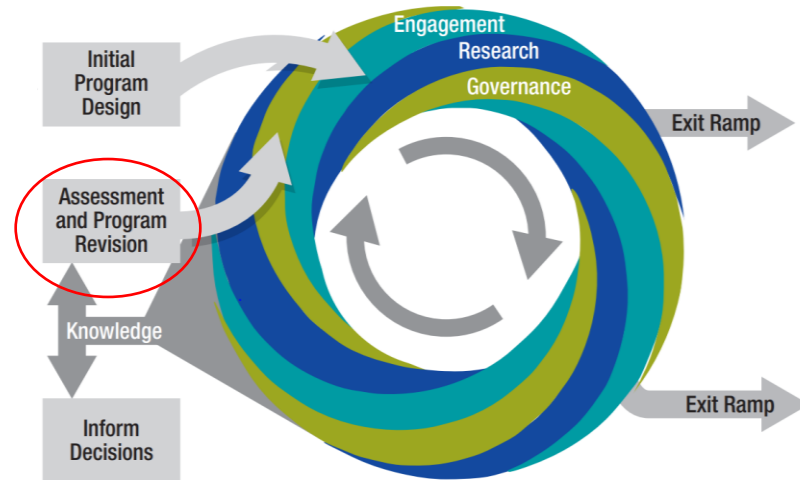
**Funders of solar geoengineering research should mandate that researchers adhere to a code of conduct that includes the following elements:**

- Protect the scientific quality of proposed research
- Assess, monitor, and minimize potential adverse effects from research
- Avoid atmospheric experiments with detectable climate or other environmental effects
- Accept research funding only from funding entities that recognize the importance of an overall balance of resources that prioritize mitigation and adaptation
- Make public research activities, funding sources, and results
- Identify and limit conflicts of interest
- Provide for suitable levels of public and stakeholder participation and engagement
- Actively support and advance the goals of racial, gender, geographic, and economic equity in the conduct of SG research

# Program Assessment and Review

Any country engaged in solar geoengineering research should:

- **establish a standing advisory body** to recommend policies and practices on research and research governance.
- **prepare regular programmatic assessments** that collectively assess the health, environmental, and social impacts of all solar geoengineering research activities that it sponsors or approves and any research program it adopts.





# Promotion of International Cooperation & Co-development on Research Teams

Funders of solar geoengineering research should promote international cooperation—including with participants from the Global South—within research teams by:

- giving **priority to research efforts that include substantial international membership or institutional cooperation** or,
- in some cases, **requiring such cooperation and co-development as a condition for support.**



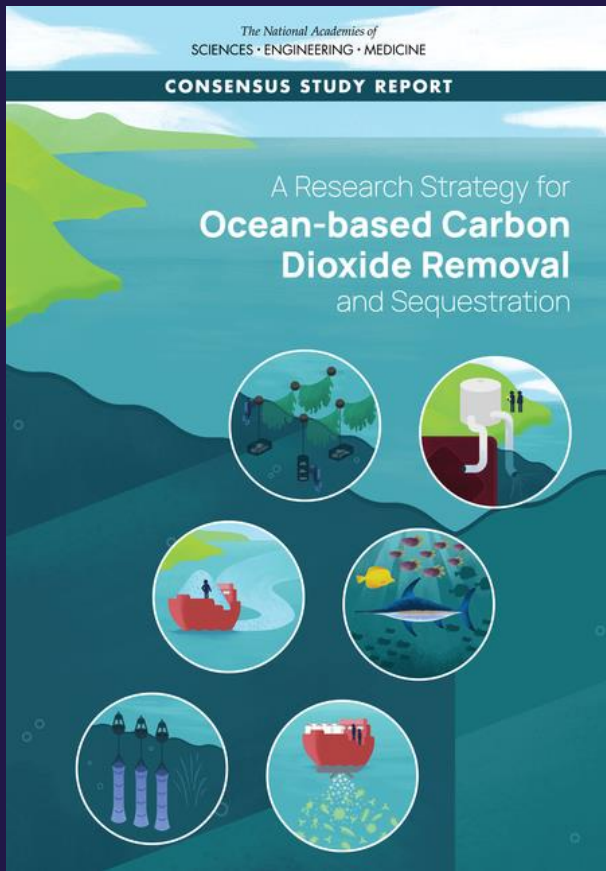
*Researchers in the field at the 5th International Conference on Community Based Adaptation to Climate Change (CBA 5).  
Photo credit: N.A. Omolo*

# Outdoor Experimentation

**Experiments that involve releasing substances into the atmosphere should be considered only when they can provide critical observations not already available** or likely to become available through laboratory studies, modeling, and experiments of opportunity (e.g., observing volcanic eruptions, rocket plumes, ship tracks).

**All outdoor experiments** involving the release of substances into the atmosphere **should be subject to governance**, including a permitting system, impact assessment, and public engagement.

Any outdoor substance releases should be **limited to a quantity of material at least two orders of magnitude smaller than that which could cause detectable changes** in global mean temperature or adverse environmental effects.



2022

**Social and regulatory acceptability is likely to be a barrier to many ocean CDR approaches, particularly ones requiring industrial infrastructure.** There will be both project-specific and approach-specific social, political, and regulatory discussions, as well as contestation around the role of CDR broadly. Field-scale trials are likely to be a site of wider societal debate around decarbonization and climate response strategies.

**Crosscutting foundational research priorities include research on international governance and the domestic legal framework of ocean CDR research. Other priorities include the development of a common code of conduct for ocean CDR research**

# New Activities

## Workshop: Climate Intervention in an Earth Systems Science Framework

Consider potential unintended consequences, synergies, and interactions among proposed climate intervention strategies and other climate responses. Focus on scientific gaps, unintended consequences on Earth systems, and sustainability, governance, and ethical concerns.

- **Climate Intervention and Agricultural Systems:** SAI effects on agricultural productivity, CDR impacts on food or biofuel production, social and equity challenges related to climate interventions in agricultural systems.
- **Climate Intervention and Coastal Systems:** marine cloud brightening impacts on coastal ecosystems and weather patterns, ocean CDR impacts on coastal ecosystems, social and equity issues related to climate interventions in coastal systems

## Study in Development: Atmospheric Methane Removal Research Agenda

Examine the need for atmospheric methane removal, assess the potential, risks, and co-benefits of viable technological options, and recommend research that could improve understanding.